Contents

Section 19

State Water Plan, Utah Lake Basin

Groundwater

Groundwater is an important element of the overall hydrologic system in the Utah Lake Basin. It provides substantial amounts of water for agricultural, municipal and industrial uses.

19.1 Introduction

This section discusses groundwater basins and their contribution to the water resources. Groundwater aquifers transfer water from areas of recharge, i.e., mountains and foothills rimming the basin down gradient to areas of discharge (springs, streams, lakes and reservoirs). Groundwater aquifers also serve as large underground reservoirs. Groundwater well owners and operators range from home owners with domestic wells to ranchers and farmers, municipalities, water districts and companies, and corporations with high production wells. As the third leading producer of groundwater, the Utah Lake Basin produces approximately 15 percent of the state's total groundwater. All major groundwater producing areas in the Utah Lake Basin were closed to new appropriation by the State Engineer in November 1995 (See Section 7 for water rights regulation).

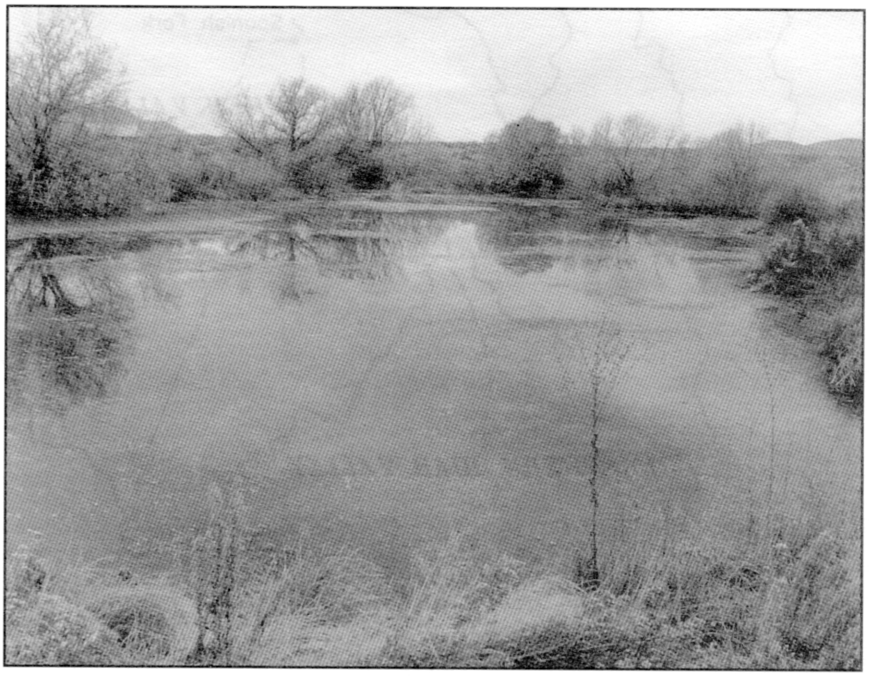
19.2 Subsurface Geology and Aquifer Characteristics

As shown on Figure 19-1, the Utah Lake Basin consists of five groundwater basins. These are Heber Valley and Round Valley in Wasatch County, Cedar Valley and Utah-Goshen Valley in Utah County, and northern Juab Valley in Juab County. Most of the groundwater developed in the Utah Lake hydrologic basin comes from unconsolidated valley fill. The valley fill, consisting of alternating granular alluvial fan deposits and finer grained lake bottom deposits, creates a number of confined, unconfined and perched aquifers as shown in Figure 19-2. Data from the five groundwater basins are summarized in Table 19-1.

19.2.1 Cedar Valley Groundwater Basin

Geologically the Cedar Valley groundwater basin is a down dropped graben (a depressed segment of the earth's crust bounded on at least two sides by faults) filled with alluvium eroded from the surrounding mountains and deposited as coalescing alluvial fans. Associated with the fan deposits are sediments laid down as ancient lake beds. These valley fill materials are coarse grained nearer the mountains along the valley margins, then become finer grained toward the center of the valley.

Discharge - Total groundwater discharge from the basin is estimated at 22,000 acre-feet with the majority (estimated at 15,000 acre-feet) leaving the basin as subsurface outflow to Utah Valley. Groundwater production is from springs and wells. Three springs west of Cedar Fort produce a combined flow of approximately 800 acre-feet annually. Fairfield Spring



Spring at Fairfield

Figure 19-1

GROUNDWATER BASIN BOUNDARIES
Utah Lake Basin

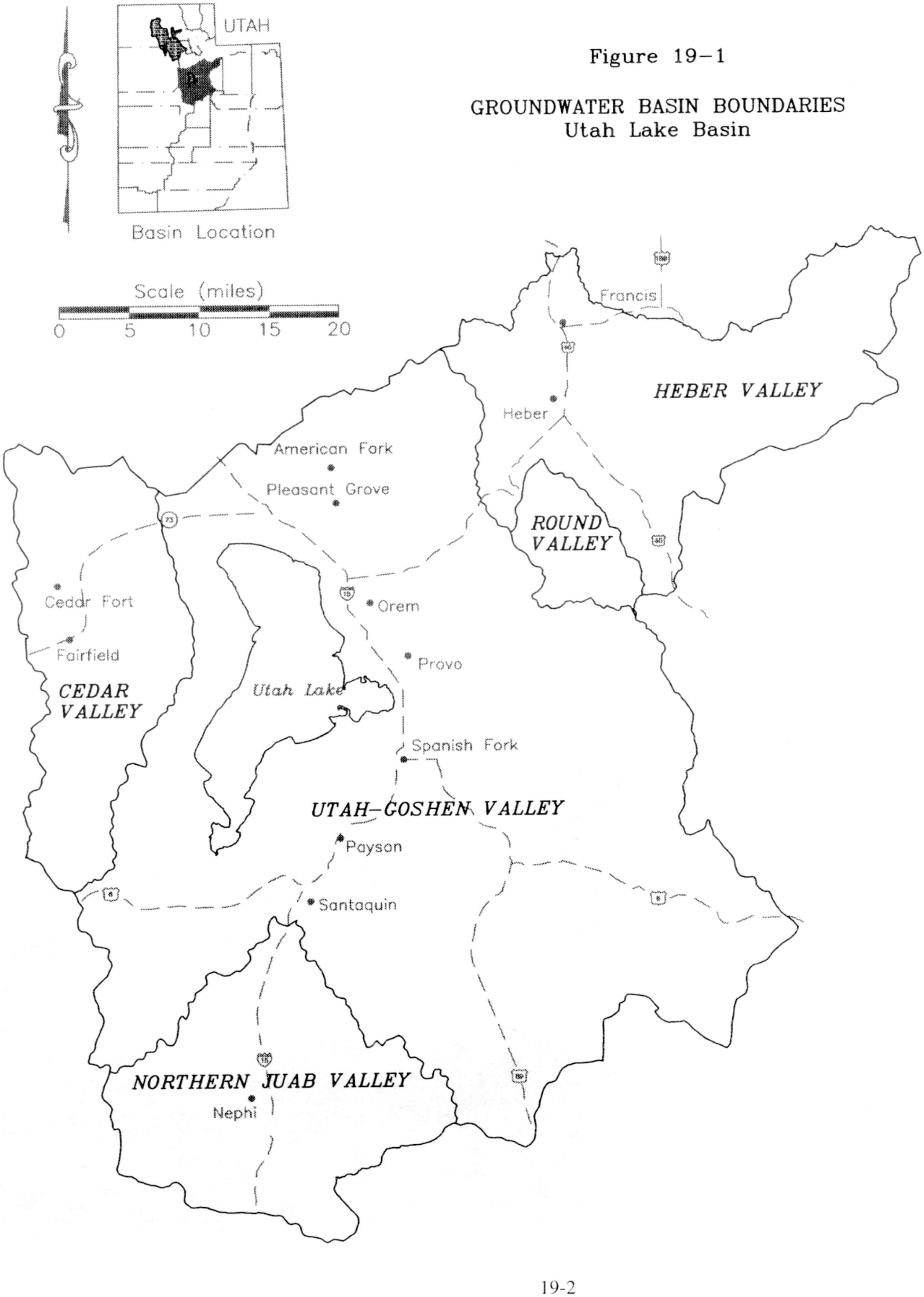
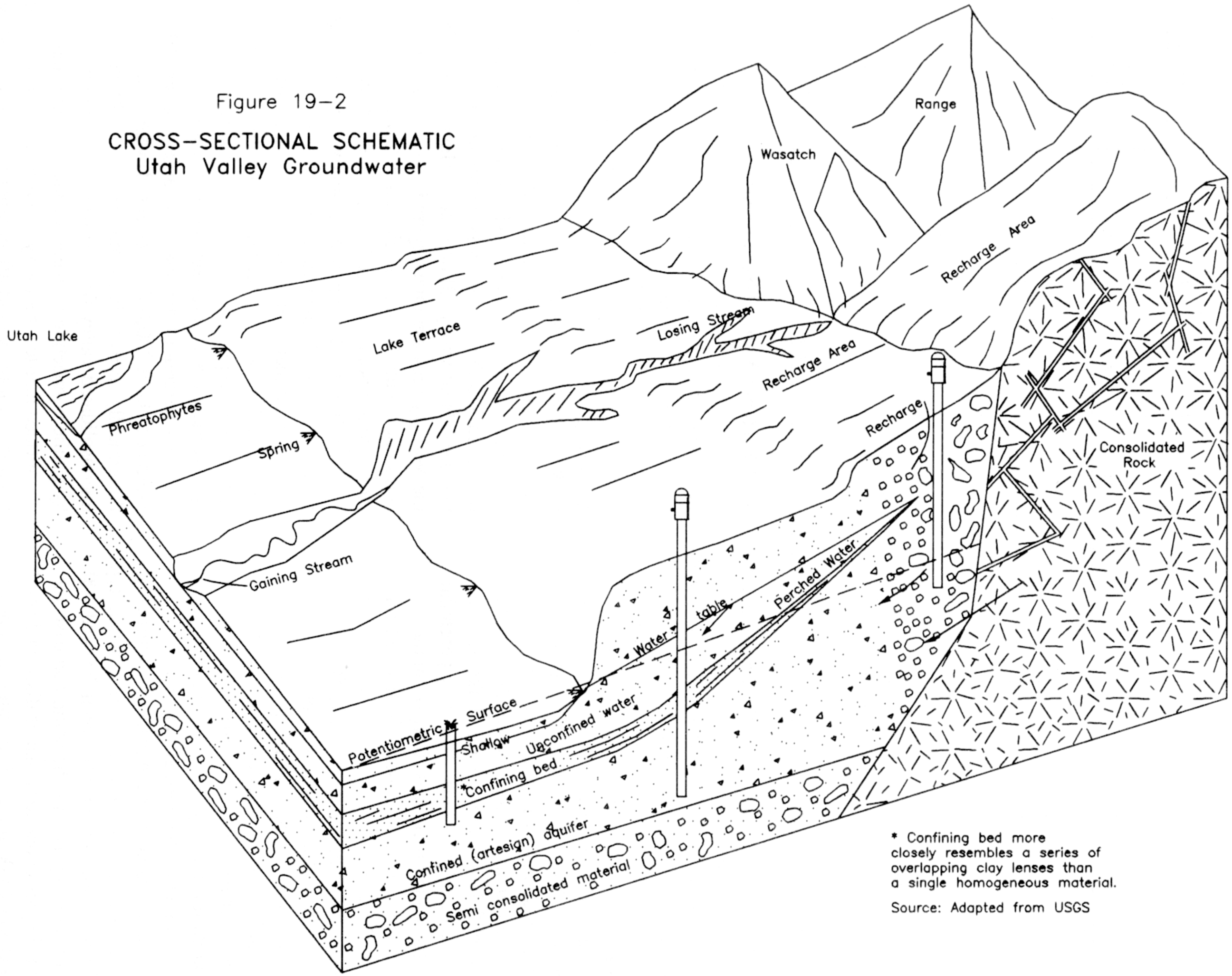


Figure 19–2

CROSS–SECTIONAL SCHEMATIC
Utah Valley Groundwater



* Confining bed more closely resembles a series of overlapping clay lenses than a single homogeneous material.

Source: Adapted from USGS

Table 19-1 AQUIFER CHARACTERISTICS OF GROUNDWATER BASINS							
Name	Aquifer	Groundwater Model	Total Discharge (acre-feet)	Withdrawals From Wells (acre-feet)	Chemical Quality	Water Right Status	Reference
Cedar Valley	Valley Fill	No	22,000	2,950	Good to Marginal	Closed	Feltis, 1967
Heber Valley	Valley Fill	Yes	111,300	870	Good to Marginal	Closed	Roark & others, 1991
Round Valley	Valley Fill	No	7,950	140	Good	Closed	Roark & others, 1991
Utah & Goshen Valleys	Valley Fill	Yes	450,000	91,260	Good to Marginal	Closed	Price, 1985
Northern Juab Valley	Valley Fill	Yes	40,000	20,500	Good to Marginal	Closed	Price, 1985

generally discharges between 3 and 5 cfs, resulting in an annual average of approximately 3,000 acre-feet. Average annual discharge from wells accounts for 3,800 acre-feet, which is less than one-fifth of the average annual discharge for the entire basin. See Figure 19-3.

Recharge - Recharge to the Cedar Valley groundwater aquifers is estimated to average 22,000 acre-feet per year. Most of this water enters the basin from precipitation and snowmelt in the Oquirrh Mountains. Other areas of recharge are the East Tintic Mountains, Topliff Hill, Thorpe Hills, Lake Mountains and their associated alluvial fans. The only perennial stream in Cedar Valley is in West Canyon in the Oquirrh Mountains, and all the water is diverted for irrigation near Cedar Fort. Between the stream bed, diversion canal, and irrigated fields, fully 50 percent of the surface flow from West Canyon (approximately 1,000 acre-feet a year) is recharged to groundwater.

Water Quality - Water quality within the Cedar Valley groundwater basin generally meets all state and federal standards for culinary use. The highest quality groundwater is found in the northern and west central part of the basin, areas nearest the principal sources of recharge. Here the water is of calcium bicarbonate type with total dissolved solids (TDS) between 200 and 400 milligrams per liter (mg/l). To the south and east, the water contains higher concentrations of dissolved solids, between 1,000 and 2,000 mg/l. The water becomes a sodium sulfate type suggesting a longer flow path and increased resident time underground.

19.2.2 Heber Valley Groundwater Basin

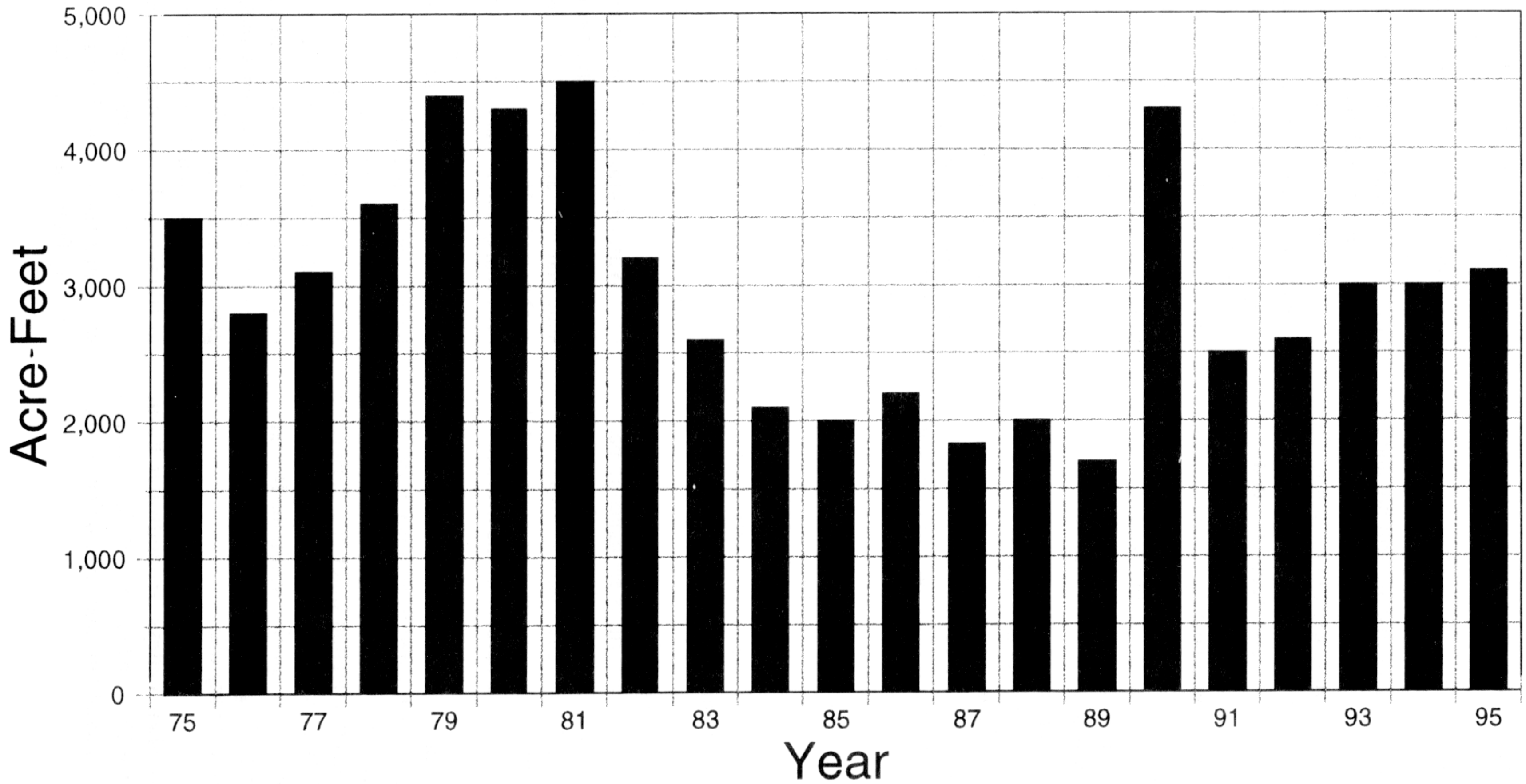
Heber Valley is an intermontane back valley. Surrounded by mountains, the valley fill is characterized as alluvial fan materials that are coarsest around the valley margins and become finer toward the valley bottom. The other component of valley fill comes from the through flowing Provo River, which in meandering back and forth across the valley has deposited fluvial sands and gravels. According to drillers' logs, discontinuous layers of clay, which have not been found to exceed 375 feet in thickness, occur in most of the unconsolidated valley fill deposits. The tufa deposits in the Midway area are interfingered and in hydraulic connection with the unconsolidated valley fill and therefore are not considered a separate hydrologic unit.

Discharge - Total annual groundwater discharge from the unconsolidated valley fill is estimated to be 111,300 acre-feet from evapotranspiration, leakage to Deer Creek Reservoir, seepage to the Provo River, springs and seeps, and wells. Well production of approximately 870 acre-feet accounts for only 7/10 of 1 percent of the total discharge. Baker (1970) estimated about 280,000 acre-feet of water was theoretically recoverable from the upper 100 feet of unconsolidated valley fill. However, due to the hydraulic connection between surface streams and the unconfined aquifer, recovery of large amounts of water from this storage would affect streamflow and existing water rights.

Figure 19 - 3

CEDAR VALLEY

ESTIMATED WITHDRAWAL FROM WELLS



Hot Pots - Thermal groundwater in and around the town of Midway is manifest at the surface as hot pots, which have no surface discharge, and hot springs that flow up to 3 cfs (Baker, 1970). The source for the heat, which is transferred to the circulating groundwater, is believed to be young intrusives that are still hot and are slowly cooling. These intrusives could underlie the Midway area, but are known to exist to the north. For example, in the Mayflower mine near Park City, temperatures as high as 65°C have been recorded on the 3,000 foot level (Kohler, 1979). The only current use for this thermal water is space heating. It is too saline to be used for culinary or most agricultural applications.

Recharge - Recharge to the Heber Valley groundwater aquifers is estimated to average 111,300 acre-feet per year. Recharge is from precipitation, stream infiltration, unconsumed irrigation water and subsurface inflow from consolidated rocks.

Water Quality - Water quality generally meets all state and federal standards for culinary use. Near Midway, however, the groundwater fails to meet state standards in either total dissolved solids or sulfate.

19.2.3 Round Valley Groundwater Basin

Mountains also surround Round Valley. Valley fill is alluvial fan deposits consisting of poorly sorted gravel, sand, silt and clay. The thickest section of unconsolidated valley fill drilled thus far is about 100 feet.

Discharge - Total annual groundwater discharge from the unconsolidated valley fill is estimated to be 7,950 acre-feet from evapotranspiration, springs, seeps and wells. Production from more than 115 small-diameter domestic and stock wells amount to about 140 acre-feet per year or about 2 percent of the average annual discharge.

Recharge - Recharge to the Round Valley groundwater aquifers is estimated to average 7,950 acre-feet per year. Recharge is from precipitation, stream infiltration, unconsumed irrigation water and subsurface inflow from consolidated rocks.

Water quality - Water quality within the Round Valley groundwater basin generally meets all state and federal standards for culinary use.

19.2.4 Utah and Goshen Valleys Groundwater Basin

Geologically, the Utah and Goshen Valley area is a string of aoalescing alluvial fans and river deltas on the hanging wall of the Wasatch Fault. The alluvium is composed of multiple layers of sand and gravel deposited at the mouths of canyons, becoming finer westward toward Utah Lake. This is interlayered with clay layers deposited on the beds of ancient lakes. Gravity and drill hole data show 1,000 feet for the depth of unconsolidated alluvium.

The State Engineer has determined the majority of groundwater discharge is tributary to Utah Lake. Groundwater development in northern Utah County is at a point of balance with tributary inflow to Utah Lake. Each additional acre-foot withdrawn via new wells will decrease one acre-foot of tributary inflow. This balance is an important element in the State Engineer's decision to close Utah and Goshen Valleys to further groundwater appropriations.

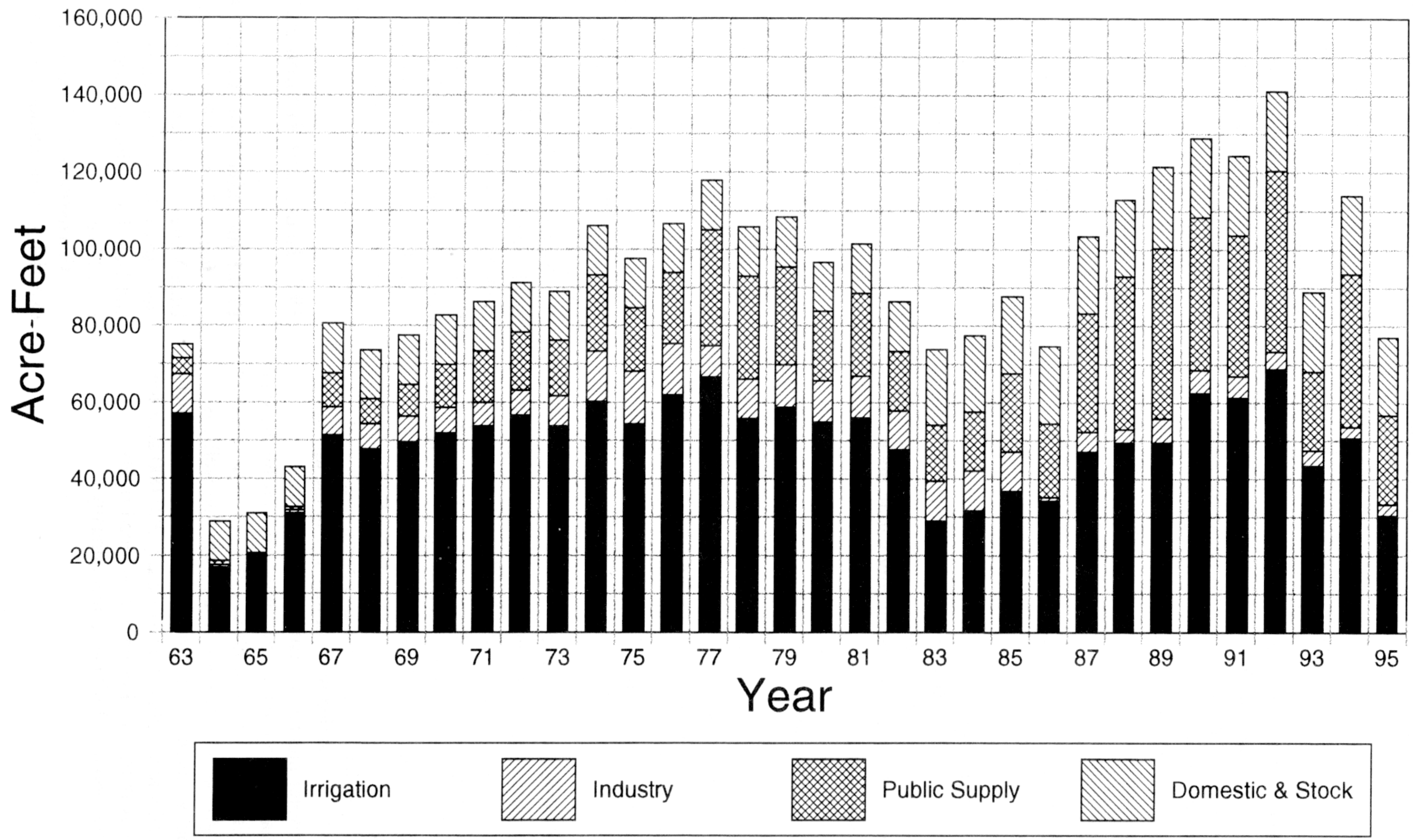
Discharge - The average annual discharge from the basin is estimated to be in balance with the recharge and amounts to 450,000 acre-feet. Discharge is to waterways and springs, wells, evapotranspiration, subsurface outflow, and diffuse seepage to Utah Lake. Groundwater production from wells for the period 1963-1995 averaged 121,000 acre-feet per year. See Figure 19-4.

Recharge - Recharge to the groundwater basin is estimated to average 450,000 acre-feet per year. Recharge is from precipitation, infiltration from stream channels and irrigation canals, seepage from irrigated fields, lawns and gardens, and from subsurface inflow through consolidated rocks.

Water Quality - Water quality within the Utah and Goshen Valley groundwater basin generally meets all state and federal standards for culinary use. The highest quality groundwater is found nearest the major sources of recharge along the east side of the basin. Here the groundwater is calcium bicarbonate type and TDS is generally less than 500 milligrams per liter (mg/l)and locally less than 250 mg/l. Two areas in the basin have degraded water quality. One is along the northwest shore of Utah Lake then north along the Jordan River to the Jordan Narrows. The second area is along the shore of Goshen Bay south to the area surrounding the town of Goshen and along Current Creek. In these areas, the groundwater is classified as slightly to moderately saline with dissolved solids concentrations ranging from 1,000 to 10,000 mg/l. The higher concentrations in these areas may be due to movement into the fill of saline water that rises along the major inferred north-south trending fault (called the Utah Lake fault, Hunt, et.al., 1953).

Figure 19 - 4

UTAH AND GOSHEN VALLEY ESTIMATED WITHDRAWAL FROM WELLS



19.2.5 Northern Juab Valley Groundwater Basin

Geologically, the northern Juab Valley is a down dropped valley against the Wasatch Fault. Valley fill consists of a series of alluvial fans and interbedded lake bottom deposits. The alluvium is coarsest against the mountain front and becomes fine toward Mona Reservoir and the middle of the valley.

Recharge - In the long-term, recharge to the groundwater basin is estimated to average 40,000 acre-feet per year. Recharge is infiltration from streams, irrigation and water conveyance systems, subsurface inflow from adjacent areas and consolidated rock, and from precipitation.

Discharge - The average annual discharge is estimated to be 40,000 acre-feet. Groundwater is discharged by pumped and flowing wells, springs and seeps, evapotranspiration and subsurface outflow. Approximately 20,500 acre-feet of the total discharge is from wells. See Figure 19-5.

Water Quality - Water quality within the northern Juab Valley groundwater basin generally meets all state and federal standards for culinary use. However, a large part of the southeastern area of the basin (centered on Nephi) has groundwater with dissolved solids concentrations in excess of 500 mg/l and two areas of concentrations which generally exceed 1,000 mg/l. These higher concentrations are apparently associated with the erosion and deposition in the valley fill of the salt-bearing Arapien shale formation exposed in the watershed east of Nephi.

19.3 Problems and Needs

Groundwater levels generally showed a significant rise through the period of 1982-1984. This was in response to greater-than-average precipitation and stream flow coupled with a decrease in the amount of groundwater pumped. Groundwater levels have generally declined since 1985. This has been in response to the less-than-average precipitation and stream flows coupled with an increase in the amount of groundwater pumped to make up the shortfall. Each basin has been closed to new appropriations by the state engineer. This should result in a close to static situation where groundwater withdrawals, including wells, is essentially matched over time by the recharge. Under approved water rights, approximately 300,000 acre-feet may be withdrawn. Presently developed rights withdraw about 152,000 acre-feet annually.

19.4 Groundwater Management Plans

The State Engineer has completed a groundwater management plan for Utah and Goshen Valleys. This plan sets conditions under which groundwater can be developed while protecting existing rights. This plan, along with the existing distribution plan (see Section 7) and coordinated operation agreements will provide a more unified water management system.

All surface waters in the Utah Lake/Jordan River system are considered to be fully appropriated. From recent studies and computer ground-water models that have been developed, the data suggest a strong relationship between groundwater and surface water sources, particularly Utah Lake. The State Engineer wants to encourage the transfer of irrigation water to municipal purposes as farmland converts to subdivisions. To accomplish this will require that change applications be filed to transfer surface water rights to groundwater sources. Utah/Goshen Valley is closed to new appropriations of groundwater.

Present groundwater withdrawals (1989-1995) for Utah/Goshen Valley average about 109,000 acre-feet. The plan provides for average annual withdrawals from wells of 160,000 acre-feet in northern Utah Valley, 100,000 acre-feet in southern Utah Valley, and 18,000 acre-feet in Goshen Valley. This amounts to 278,000 acre-feet. Subtracting the 109,000 acre-feet present use results in an average potential withdrawal of 169,000 acre-feet. These amounts are conditioned upon the assumption the effect on surface water rights can be mitigated.

To develop this amount of water for municipal use would require well capacities of 2 to 2.5 times the amount of water now developed to meet seasonal peaking demands. Holders of Utah Lake water rights in Salt Lake County have objected to transferring their rights for use in Utah County. Those factors may limit the amount of groundwater developed in the Utah/Goshen Valley for use in Utah County.

19.5 Issues and Recommendations

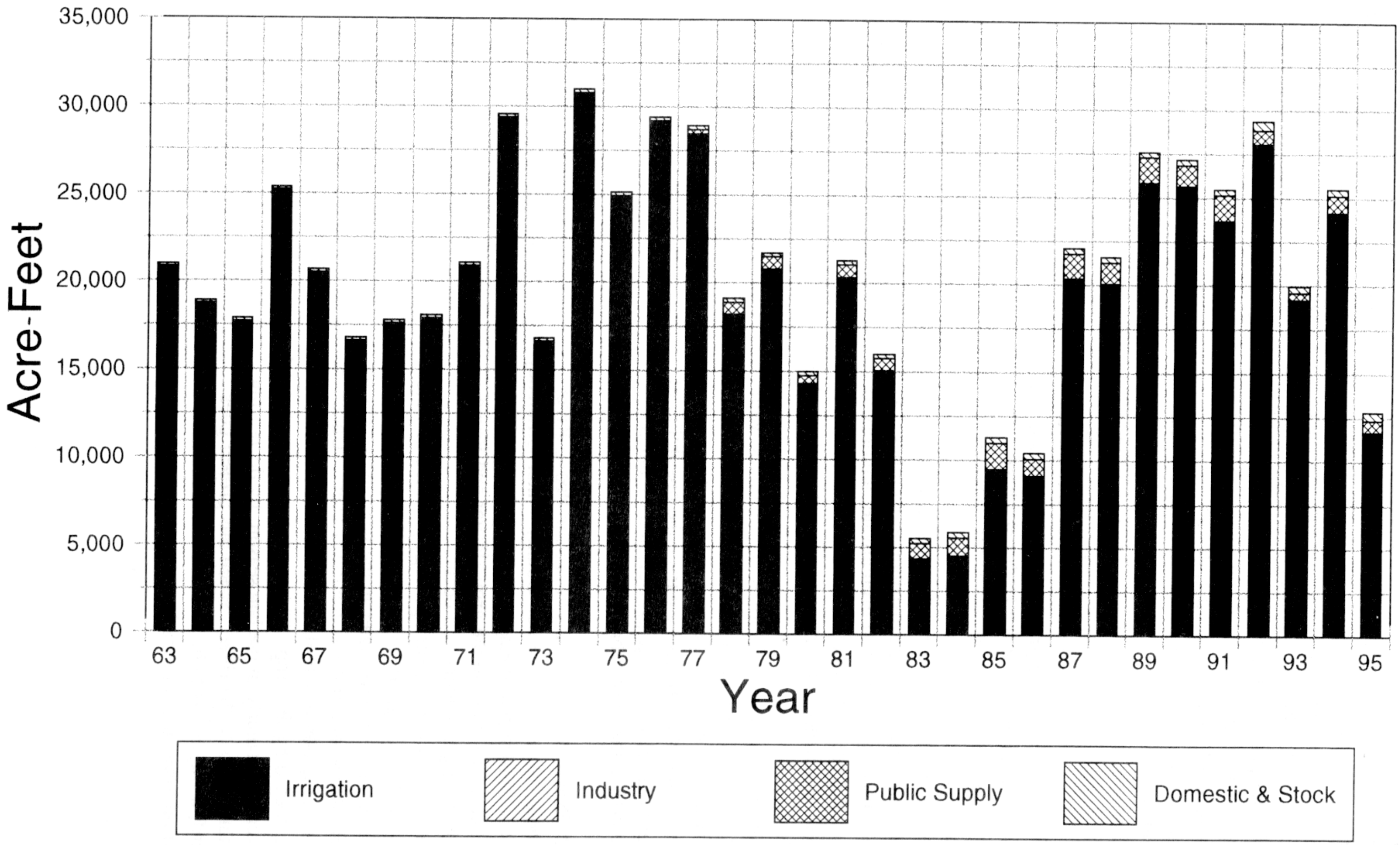
19.5.1 Increased Groundwater Use

Issue - Demand for groundwater development in Utah Valley is increasing as population expands. Because of the relationship between the groundwater and Utah Lake, this development could affect inflow to Utah Lake.

Discussion - As Utah Valley and the other basins experience a continuation of moderate to rapid growth,

Figure 19 - 5

JUAB VALLEY
ESTIMATED WITHDRAWAL FROM WELLS



a shift from predominately agricultural usage toward more municipal and industrial use will result. Local water providers will eventually be faced with the necessity of either expanding existing surface water treatment and distribution facilities or increasing current groundwater pumping rates to supplement M&I water supplies. The former option would require significant costs associated with the planning, design and construction of new and/or expanded treatment and distribution facilities.

However, the construction of injection wells or infiltration beds strategically near Provo and Spanish Fork canyons would potentially recharge a relatively large area of the existing groundwater aquifer near the most populated portions of the Utah Lake basin. The recharged aquifer would then allow for increased pumping rates at existing well sites and to a significant degree, eliminate the need for the construction of large surface water treatment and distribution facilities. At the same time, monitoring of groundwater aquifers to assure that Utah Lake water rights are not impaired is required. Exchanges of surface water with wells is also an option.

Recommendation - Major water suppliers, with funding and guidance from the Central Utah Water Conservancy District and permits from the State Engineer, should aggressively pursue the possibility of large groundwater recharge projects and exchanges, particularly in the most urbanized areas of Utah Valley.

19.5.2 Protecting Water Rights in the Provo River

Issue - When the Wasatch County Water Efficiency Project is constructed, changes in the historic pattern of irrigation return flows to the groundwater and Provo River water right holders will occur.

Discussion - In the spring, large amounts of water are diverted by irrigators to raise soil moisture; this water returns to the river later in the year and serves to augment late season flows to the lower users. Under the pressure irrigation proposal, water would be delivered as it is needed by the crop. This will alter the regime of the river, particularly in the late season, by decreasing the return flows to the river. When this project goes forward, a way needs to be found to minimize the impact on lower users in the late season.

Recommendation - The State Engineer, in consultation with local water users, the Bureau of Reclamation, and the Central Utah Water Conservancy District, should continue to insure that prior water rights on the Provo River are protected and factored into project plans. ✤ ✤